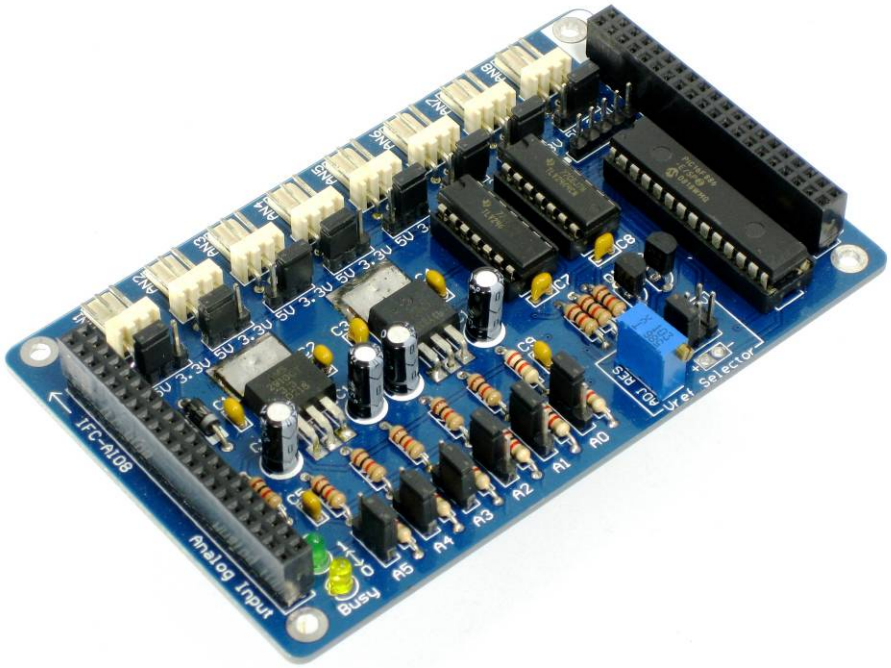
IFC-AI08
Interface Free Controller
Analog Input Card



User's Manual

V1.0

Sept 2008

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1. INTRODUCTION AND OVERVIEW

1.1 Introduction of Interface Free Controller

IFC (Interface Free Controller) offer a new concept of developing microcontroller embedded system and also robotics system. With IFC, no more frustration in determine hardware interface and configuring peripheral in software. Checking few hundreds pages of data sheet can be waved. With the concept of interfacing card, user may stack as many as 64 cards in a system to get infinite combination of peripherals. The design aim is to offer 3 simple steps in microcontroller system development – Configure card's address, Stack IFC cards, Write Program and Run!

Furthermore, with functions based software library, user save valuable time during software development by concentrating on algorithm development. No more flipping or scrolling PIC data sheet looking for ADCON0, T1CON or even TRISA. With just a programming hand book, user may simply copy the header file, call comprehensive functions and it's ready to rock.

IFC come with a brain card (main controller) where the main program is loaded. There are several cards available for robotics development such as control panel, 15A brush motor driver, brushless motor controller, counter and digital input, output card, power card, analog input card and PS2 Controller card. This document will focus on Analog Input card, IFC-AI08. This card has been designed with capabilities and features of:

- Industrial grade PCB.
- Every component is soldered properly and tested before board is shipped.
- Circuit power and busy indicator LED.
- 12V operation.
- 6 set of 1x3 headers to select communication address.
- **8 analog input ports**.
- **5V** or **3.3V** selectable power source to various kind of sensor.
- Selectable **sampling rate** and **average rate** for every analog channel independently.
- Software configurable **10bit or 8bit** analog resolution.
- Maximum of 64 analog cards can be stacked.
- Selectable V_{ref} for IFC-AI08 (**3.3V, 5V or adjustable V_{ref}**).
- **Dimension** 11.1cm x 6.9cm
- Come with sample code and template to start.

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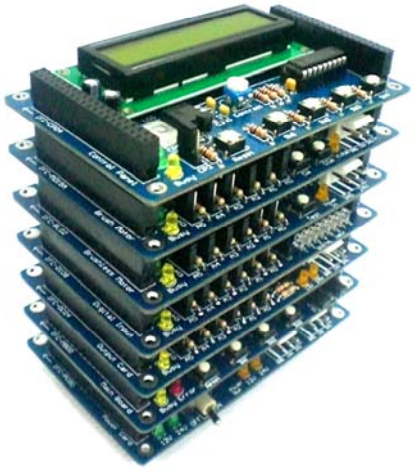
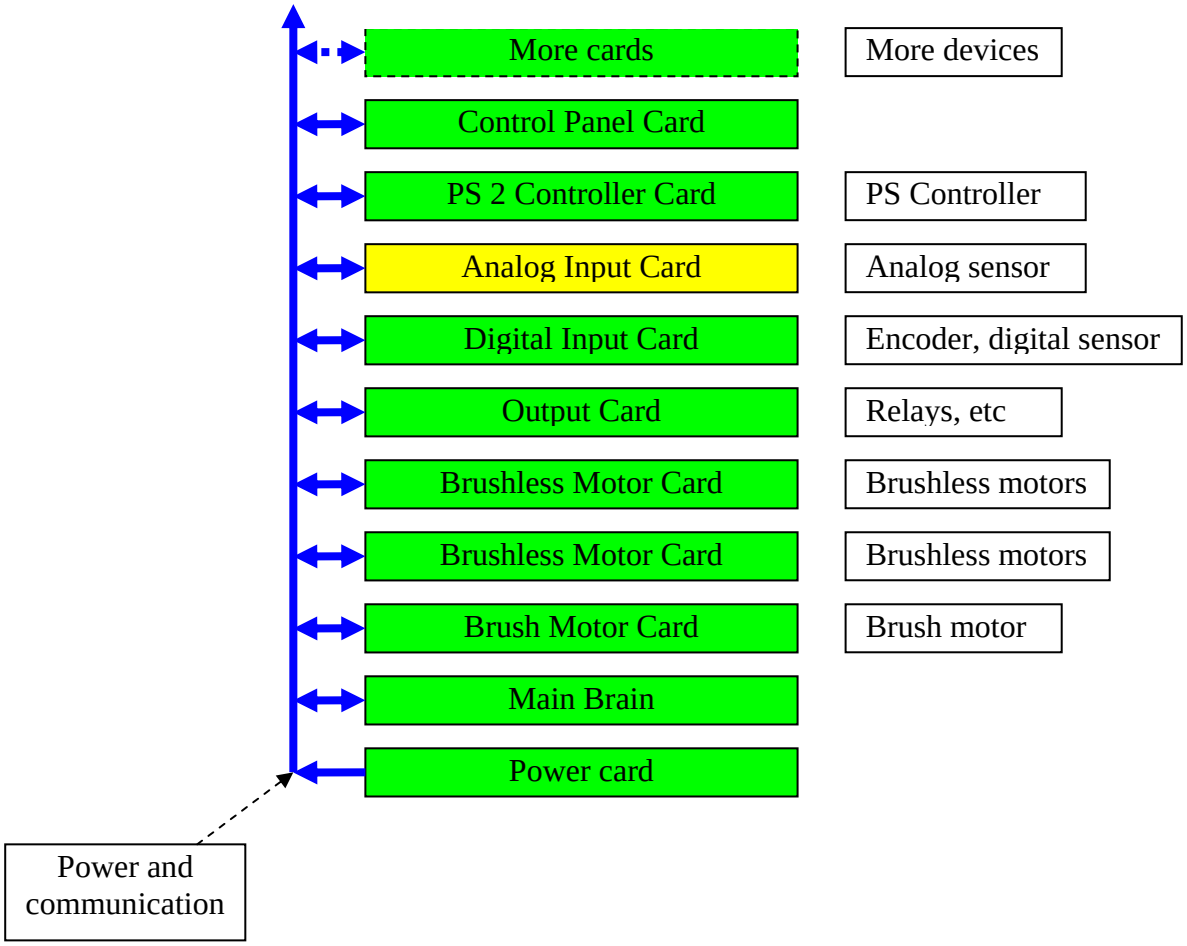
1.2 System Overview

With serial communication perception, IFC offer million of possibilities to develop embedded system creatively and easily. In IFC, several cards are stacked to get a complete embedded system. The minimum card requires is Power card and Main Board.





This document explains the method to use IFC-AI08.

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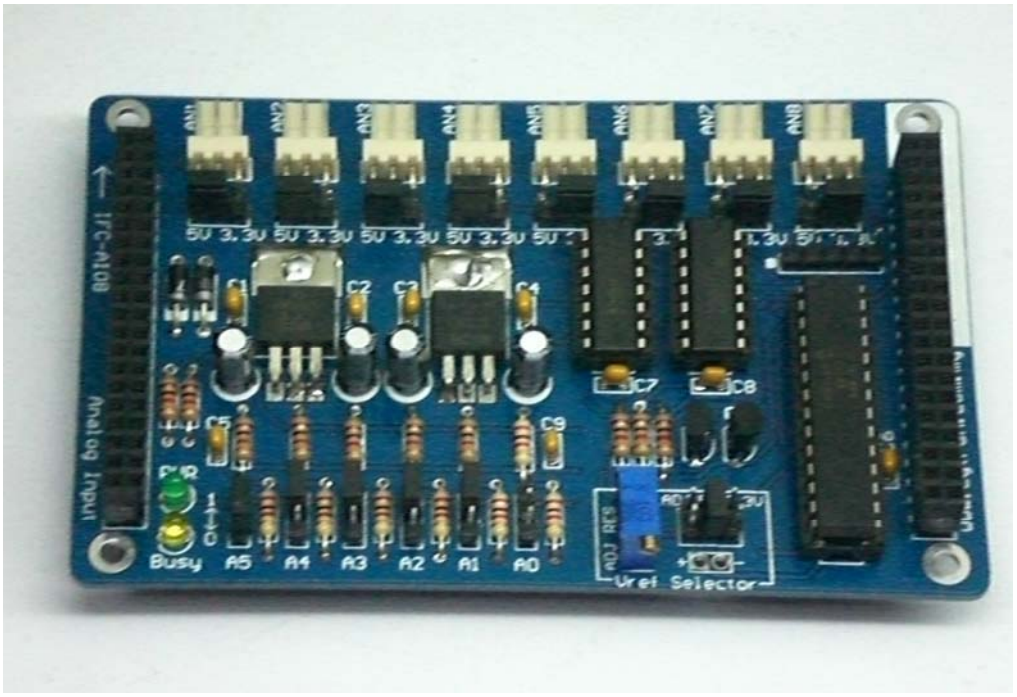
2. PACKAGING LIST

Please check the parts and components according to the packing list. If there are any parts missing, please contact us at sales@cytron.com.my immediately.



1. 1 x IFC Analog Input Card, IFC-AI08 with:
   - Industrial grade PCB with every component soldered properly.
   - 15 x mini jumper
   - 8 x Female connector (2510-03) for analog port.
   - 24 x Iron Pin (2511)

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3. PRODUCT SPECIFICATION

3.1 Communication Address

There are 64 (2^6) communication address of IFC-AI08 that can be selected. The 6 bits communication address is determine by selector A5 through A0 (6 set of 1x3 headers on IFC-AI08). User can set the card address by using the mini jumper. However, user need to make sure the communication address chosen on board is compatible with program written in Main Board.

3.2 Programmer

User **does no need** to prepare programmer for IFC-AI08. IFC-AI08 is one of the slave cards of IFC system. The slave program is preloaded before shipped to customer. User will only need the Main Board of IFC system, IFC-MB00 to control this slave card.

3.3 Input and Output device

The output devices on AI08 are as below:

- 2 status indicator LED: Power and busy LED:
  - Power LED (PWR) will turn ON when power supplied to IFC-AI08 card.
  - Busy LED (Busy) will turn ON or blinking when IFC-AI08 is communicating with master card, IFC-MB00.

The input devices on AI08 are as below:

- 8 analog input ports ready with selectable power source:
  - Selectable power source for each analog input port (3.3V or 5V). User can select the input devices power source by using the mini jumper.
  - Analog input devices that can be connected to the analog port are:
    - Sharp Infrared Distance Sensor
    - Maxbotix Ultrasonic Sensor
    - Accelerometer
    - Gyro
    - IMU
    - More….

3.4 Operating Voltage

The operation voltage of IFC-AI08 is 12V. User needs to stack a Power Card, IFC-PC00, and connect a 12V battery on Power Card to supply 12V to Analog Input Card. Please refer hardware setup in chapter 5.0 Installation (hardware) for connecting power to Analog Input Card.

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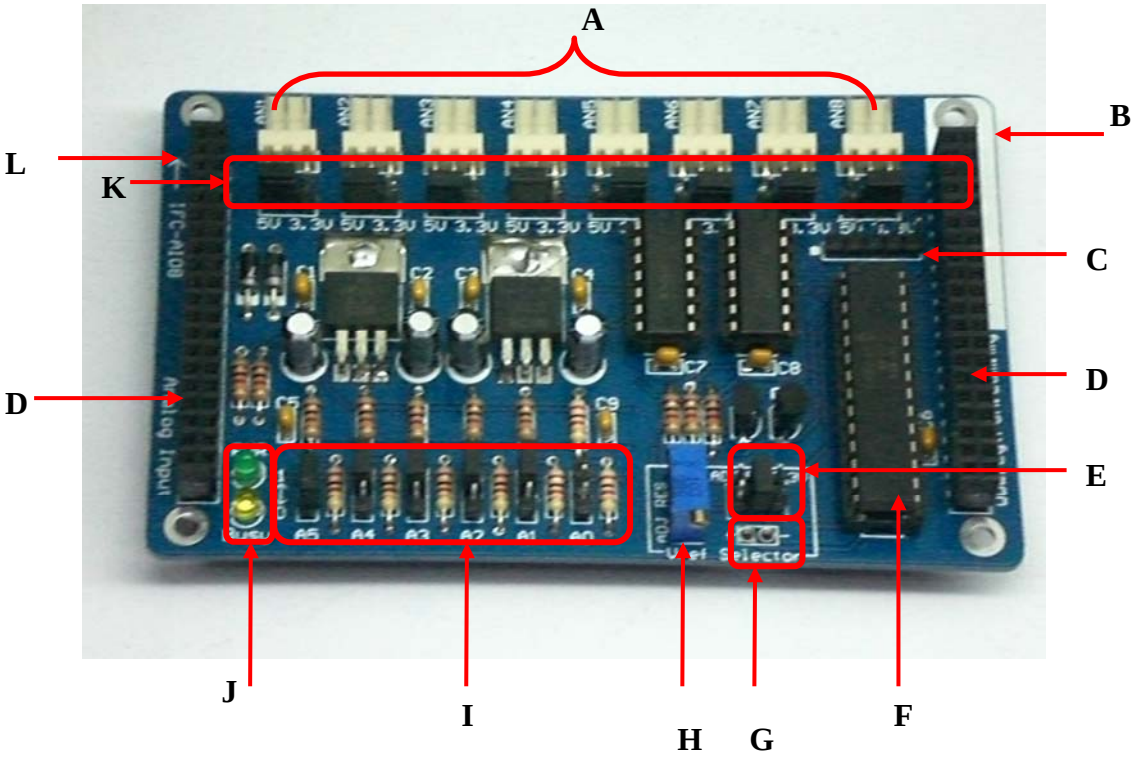
4. BOARD OR PRODUCT LAYOUT



Label	Function	Label	Function
A	Analog Input port	**G**	Vref test point
B	Orientation marking	**H**	Adjustable resistor for Vref
C	Manufacturing Test Points	**I**	Communication address selectors
D	Side connector	**J**	Status indicator LED
E	V_{ref} selector	**K**	Input device voltage selector
F	PIC Microcontroller	**L**	Arrow marking

A – 8 analog input ports ready with selectable power source.

B – The orientation marking on IFC-AI08. Every IFC card has this orientation marking, this is to help user in ensure the cards are stack correctly.

C – Reserved for Manufacturing Test Point. Please DO NOT short or connect wire to any of these pins.

D – Side connector for stack card and communication between cards.

E – V_{ref} selector. User can use mini jumper to select V_{ref} for IFC-AI08 either 3.3V, 5V or adjustable V_{ref}.

F – 28 pin PIC microcontroller which used as controller for this slave card.

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G – Vref test point for IFC-AI08. User can simply use this test point to check voltage of V_{ref}.

H – Adjustable resistor. User can simply adjust this resistor to get V_{ref} needed.

I – 6 set of 1x3 headers use as communication address selector on IFC-AI08. User can set the card address by using the mini jumper.

J – 2 status indicator LED to indicate status for power ON (PWR) and busy in communicate with Main Board card (Busy) PWR LED will turn ON when power supplied to the board. Busy LED will turn ON when the card is busy in communicate with master card, IFC-MB00.

K – 8 input voltage selectors on IFC-AI08. User can use mini jumper to select either 3.3V or 5V for input voltage of each input port.

L – An arrow mark to help user in ensuring the cards are stack correctly. Every IFC card will have this arrow mark; user needs to ensure that the arrow points to the same direction when IFC cards are stack together.

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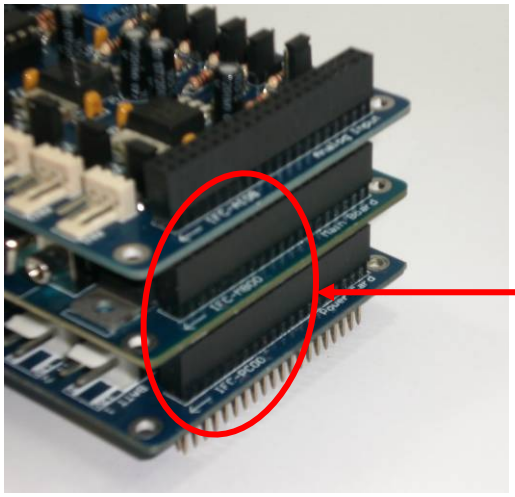
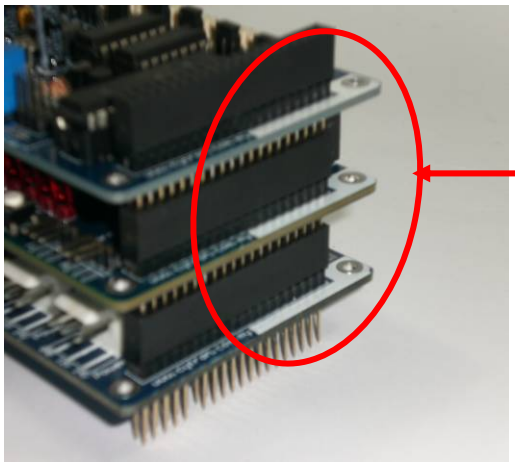
5. INSTALLATION (HARDWARE)

For hardware installation of IFC-AI08, user will first need the Main Board card (IFC-MB00) and Power Card (IFC-PC00) of IFC system. IFC-MB00 is the main controller of IFC system while IFC-PC00 is the main power supply. For installation of IFC-MB00 and IFC-PC00 please refer to the user's manual of IFC-MB00.

After user obtain the IFC-AI08, user can stack it on IFC system as shown in Figure.



Ensure the arrow points to the same direction.



Ensure the orientation marking at the same side.

Cautions: Please ensure that every card is being stacked properly in correct orientation. Whole IFC system will be damaged if one of the cards is being stacked wrongly when it is powered up.

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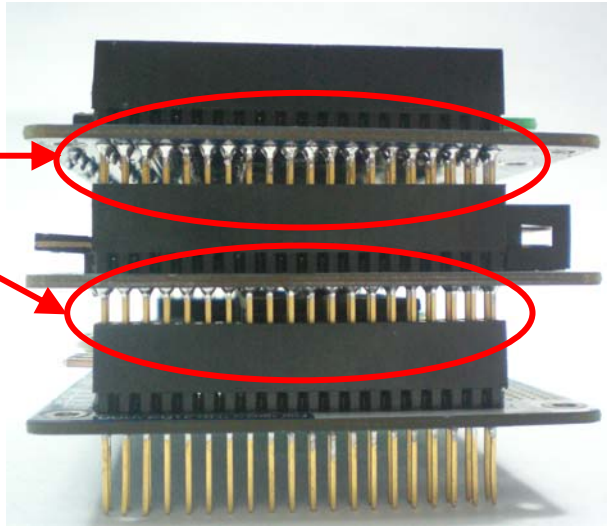
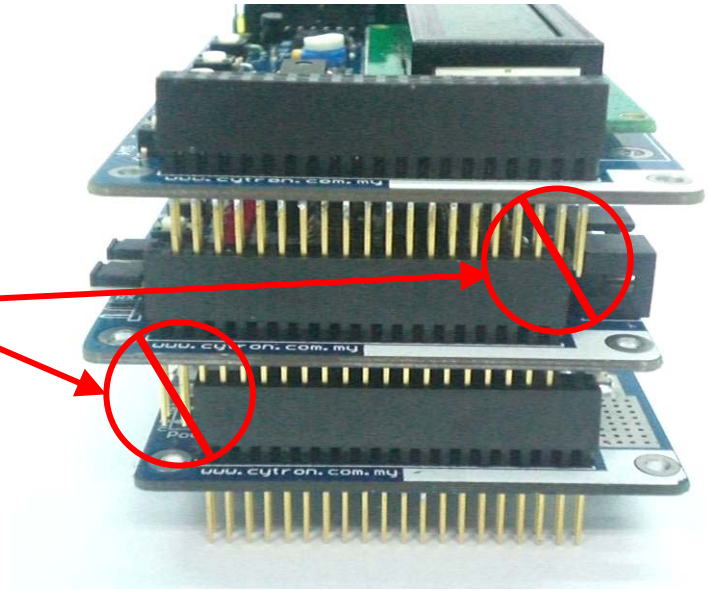
Besides stack every card in correct orientation, user must also require to ensure all card pins are not shifted when stacking. Figures show the example of stacking cards in proper location and example of stacking cards with shifted pins.

Ensure that all card pins are not shifted when stacking.

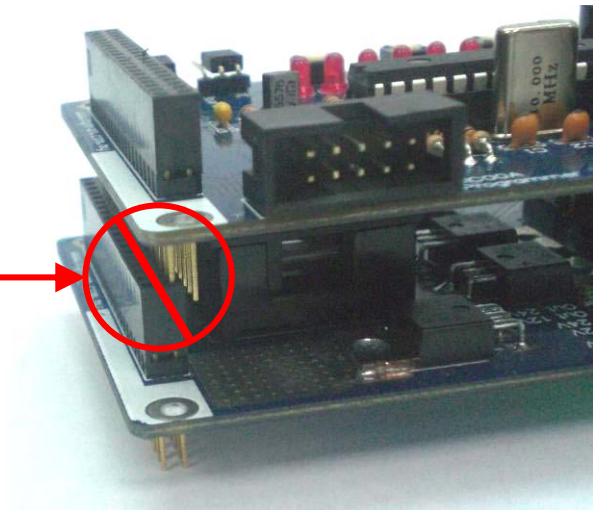


Examples of stacking cards with shifted pins. Please AVOID this!



Ensure that all card pins are not shifted when stacking.

Examples of stacking cards with shifted pins. Please AVOID this!



Cautions: Please ensure that all card pins are not shifted when stacking. IFC system will NOT function if the pins are shifted.

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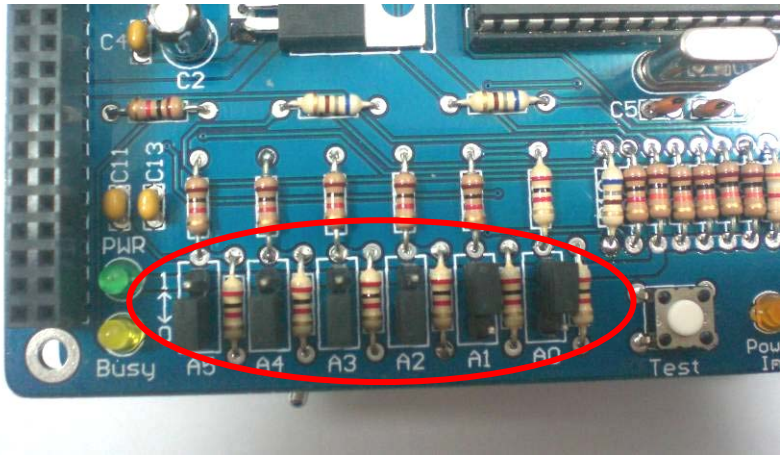
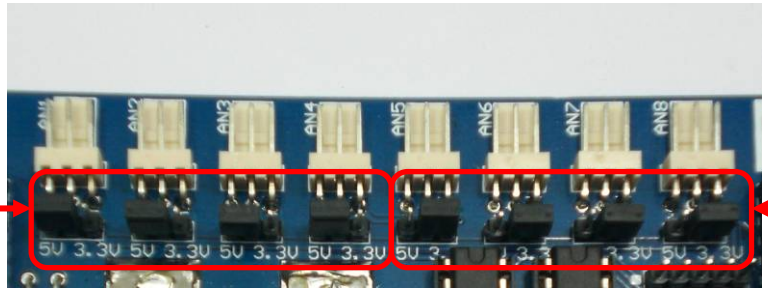
User can use the mini jumper provided on IFC-AI08 to select the communication address of IFC-AI08. For example, figure below shows the communication address, 000011 selected. Please make sure the address selected is compatible with the program. Please refer chapter 7 for details of writing program for IFC-AI08. Each slave card must have unique address.



User also needs to select the suitable voltage (3.3V or 5V) to supply to the input device connected to AI08 depending on the device's specification. Every analog port has its own voltage selector. Please refer User's Manual for IFC-MB00 for the connection of battery to Power Card. Figure below shows that 5V was selected for AN1, AN2, AN3, AN4 and 3.3V was selected for AN5, AN6, AN7, and AN8.

5V was selected for AN1, AN2, AN3 and AN4



3.3V was selected for AN5, AN6, AN7 and AN8

Caution: Please ensure that only ONE input voltage range (3.3V or 5V) selected for each selector.

Next, user needs to select V_{ref} for IFC-AI08 card. There are 3 selection of voltage to supply as Vref which are fix 3.3V, fix 5V and adjustable V_{ref}. By using mini jumper, user is required to select only one Vref preferred (3.3V, 5V or adjustable V_{ref}). If the adjustable Vref is selected, the adjustable resistor (ADJ RES) is used to adjust the Vref voltage to desired level from 0 to 5V. Figure below show that 5V is selected V_{ref}.

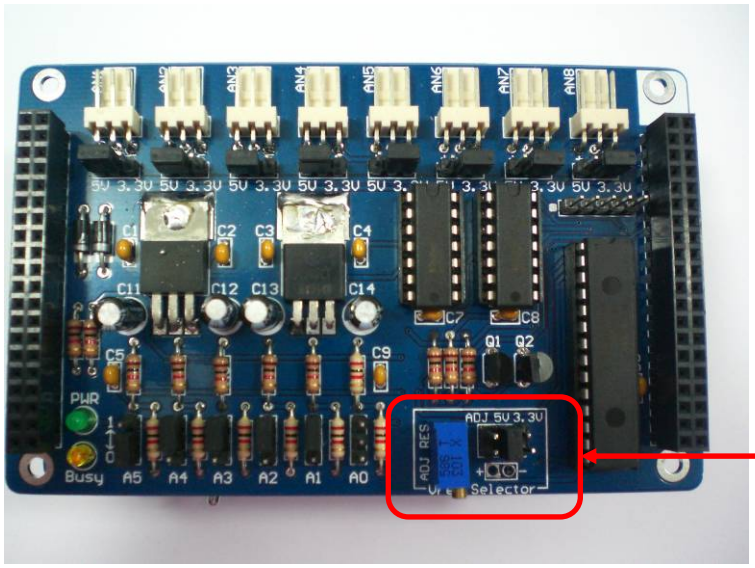


Figure below shows adjustable V_{ref} is selected. User can adjust the adjustable resistor to set the V_{ref} voltage. The voltage for Vref can be checked using multimeter through the Vref test point as shown in figure below.

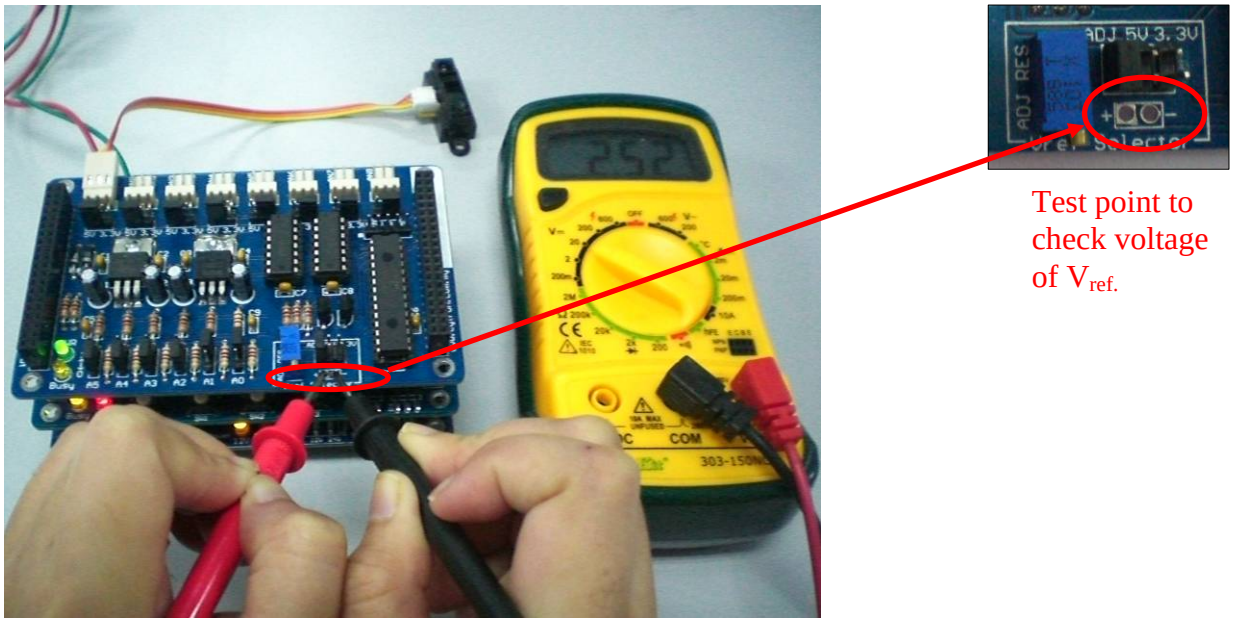


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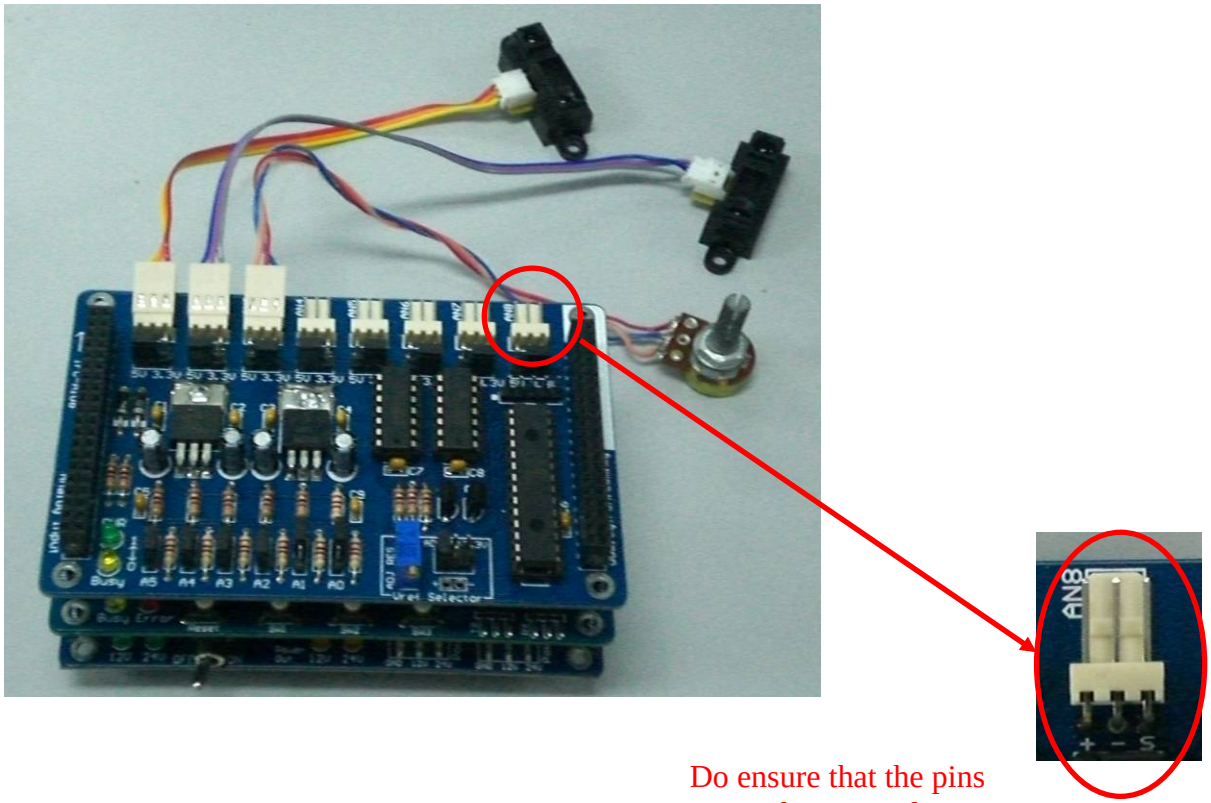
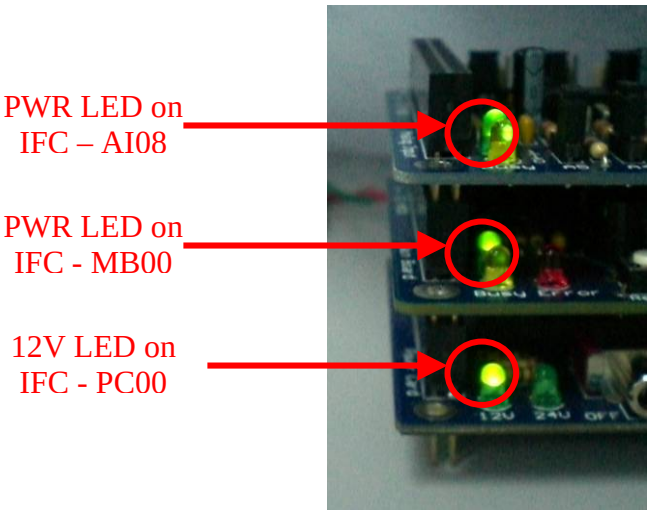
Figure below shows how to connect the analog devices to analog input port. Be sure that the voltage selector is selecting the right voltage which is supply to the input device. Before connecting the input device to input port, user needs to ensure the sequence of pin for input device is compatible with the sequence of pin offered from analog input card which is clearly marked on the board (right[+,-,signal]left).



Next, turn ON the power through Power Card, the PWR LED of IFC-AI08 will turn ON as shown in Figure. Initially, if there are no functions related to IFC-AI08 being called in Main Board's program, the busy LED will not turn ON or blink.



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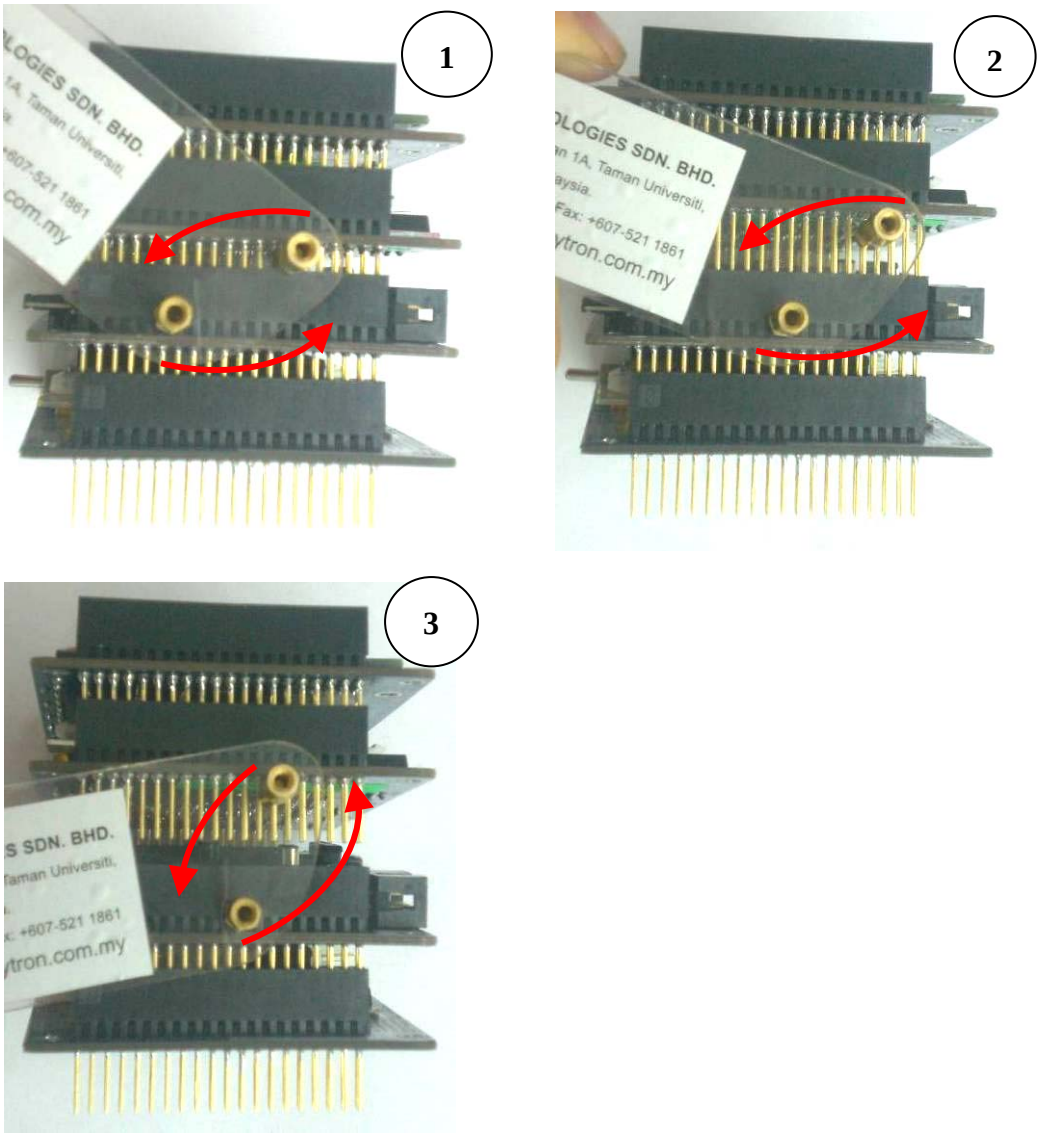
To open the cards, user can use the IFC card's opener to open the stacked cards. Figure shows the method to open cards with the opener.



Caution: Please use the opener to open IFC cards to avoid damage of the pins or cards.

6. INSTALLATION (SOFTWARE)

User only needs to write program in IFC-MB00 in order to send data and communicate with IFC-AI08. A program editor, C compiler and UIC00A software are required to be installed for user to write program, compile it and further load program to IFC main board. User is recommended to use MPLAB IDE as source code editor and MPLAB C18 as C compiler. Both this software is from Microchip and it is provided freely to download. Please refer user's manual of IFC-MB00 for the installation of MPLAB IDE and MPLAB C18 compiler. As for the installation of UIC00A software, please refer to UIC00A User's Manual.

Please refer to MB00 User's Manual, Chapter 6 for details step to install MPLAB IDE and C18 compiler.

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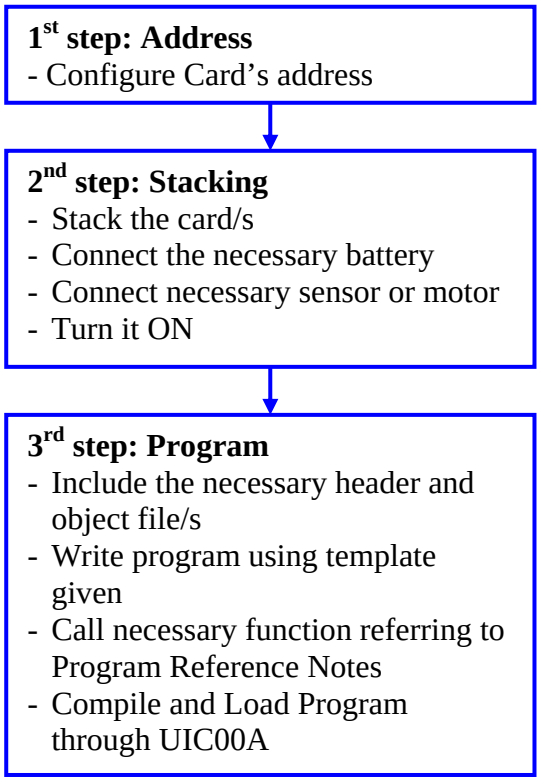
7. GETTING STARTED

IFC is being design with the aim of 3 simple steps to use it. Configure card address, Stack it, Load program and run. There must be at least power card (IFC-PC00) and main board (IFC-MB00) for this system to function. This section will show the example to operate it with Analog Input Card, IFC-AI08.


1st step: Address
- Configure Card's address
2nd step: Stacking
- Stack the card/s
- Connect the necessary battery
- Connect necessary sensor or motor
- Turn it ON
3rd step: Program
- Include the necessary header and object file/s
- Write program using template given
- Call necessary function referring to Program Reference Notes
- Compile and Load Program through UIC00A

There is a basic setup in this chapter for IFC-AI08; the example includes 4 cards, IFC-PC00, IFC-MB00, IFC-AI08 and one extra card, which is IFC-CP04. Please refer to the following section of this chapter for setup details.

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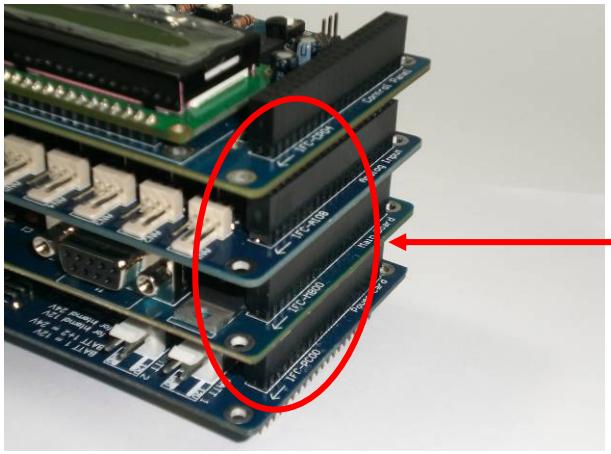
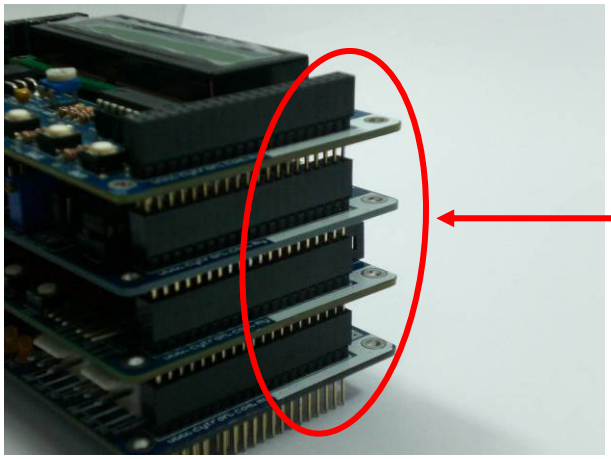
7.1 Basic Setup with Control Panel (IFC-PC00 + IFC-MB00 + IFC-AI08 + IFC-CP04)

Adding a control panel which comes with a 2 x16 character LCD and 4 programmable push buttons will offer more interesting demonstration. Following steps show the installation of this system and method to operate it.

a. 1st step, configure the address of cards, IFC-AI08 and IFC-CP04. Analog Input Card has 6 mini jumpers to configure communication address (A5-A0). It should be set to 000011 if sample source code is being used. As for Control Panel, it should be set to "CP1" (Upper side).

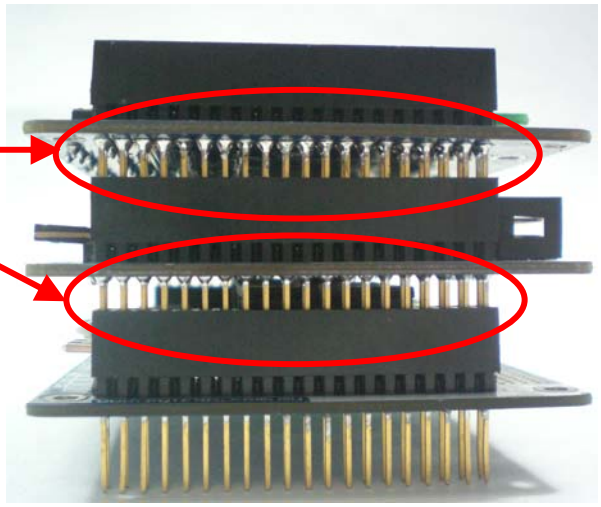
b. 2nd step is to stack all 4 cards together. The ideal stacking sequence is Power card (IFC-PC00) at the bottom, Main board (IFC-MB00) at 2nd layer, Analog input Card (IFC-AI08) at 3rd layer and Control Panel at the top layer as shown in following figure.





c. Besides stacking every card in correct orientation, user also needs to ensure that all the pins when stacking are not shifted and inserted to correct location.

Ensure that all the pins when stacking are not shifted and inserted to correct location.



d. Connect analog input device such as analog distance sensor to input ports. Please refer hardware setup for connecting input devices to Analog Input Card.

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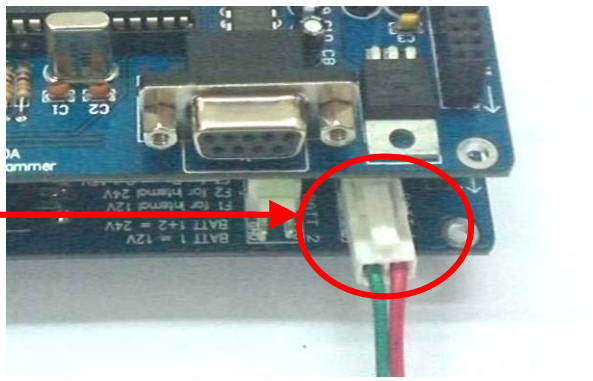
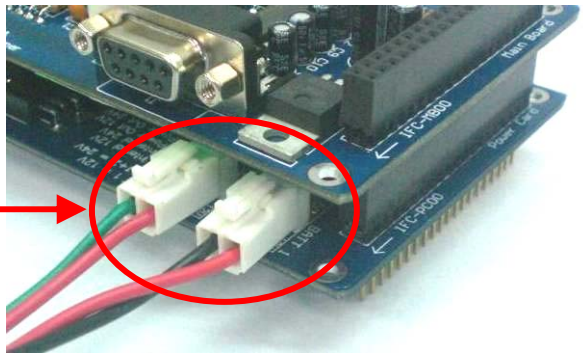
e. Connect the battery to Power card as shown; please ensure the **polarity is correct**.

Connect 1 x 12V battery to supply operating voltage to IFC**. Ensure the polarity is correct**.



If 24V is needed in the system, connect 2 x 12V batteries to PC00. **Ensure the polarity is correct**.



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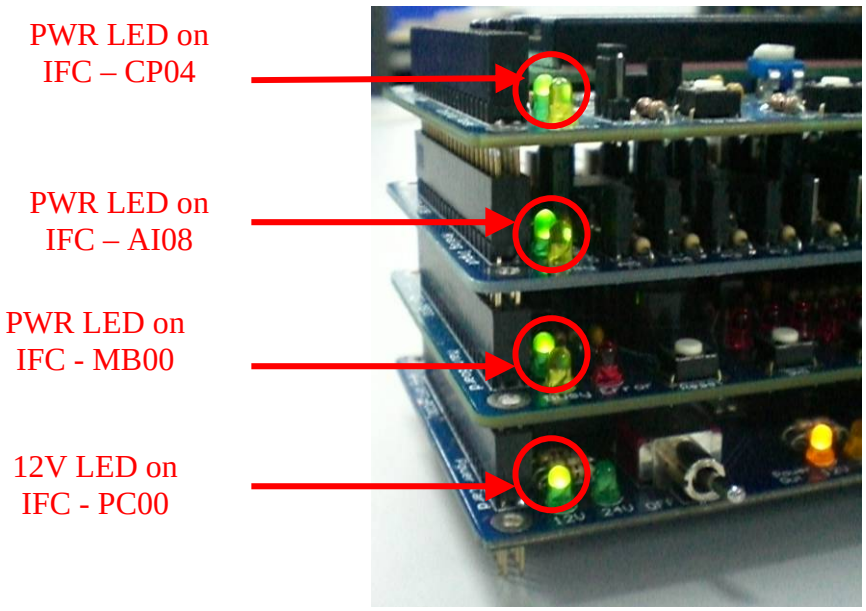
f. Turn ON the IFC power by pushing the toggle switch to "ON". There should be at least 4 LED (12V LED on Power Card, PWR LED on Main Brain, PWR LED on Analog Input Card and PWR LED on Control Panel) light up as show.



g. 3rd step is to write program and load it. IFC comes with comprehensive function to save program development time. Functions library will come with the interfacing card in the form of header file (*.h) and object file (*.o). In order to call these functions, particular header file and object file must be included under a project.

h. Open MPLAB IDE (please ensure MPLAB C18 compiler is being installed). User can follow the step in chapter 6.2 of user's manual on how to open a project named "IFC_AI08" in MPLAB IDE. Before start writing program, please note that the header file (iic.h, iic_ai.h and iic_cp.h) and object file (iic.o, iic_ai.o and iic_cp.o) for IFC-MB00, IFC-AI08 and IFC-CP04 have to be included in the project in order to use the functions of these cards. A sample source code named "Sample1_AI.c" will be provided for user to load in the main board card (MB00) in order to test the analog input card using control panel card (CP04). Even though user do not use the provided sample source code "Sample1_AI.c", the related header and object file must also be included in the project before start a new programming. Figure shows the example to include the header file, object file and sample code file.

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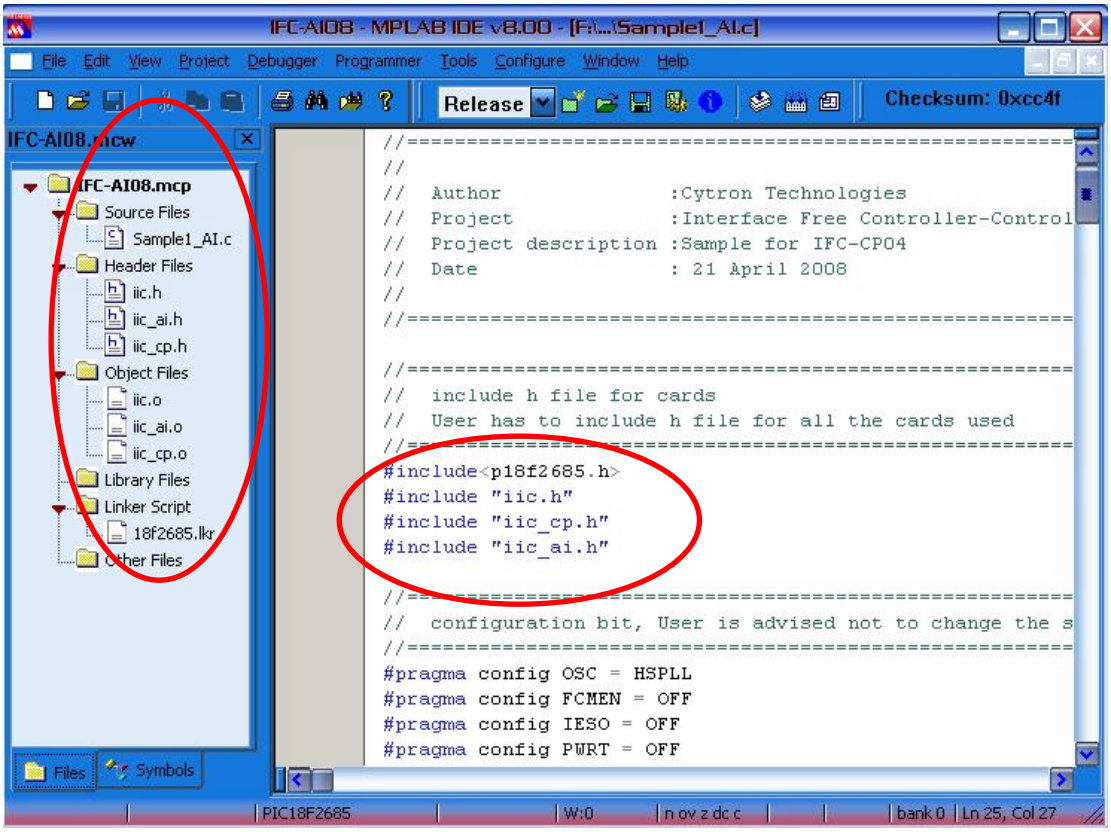
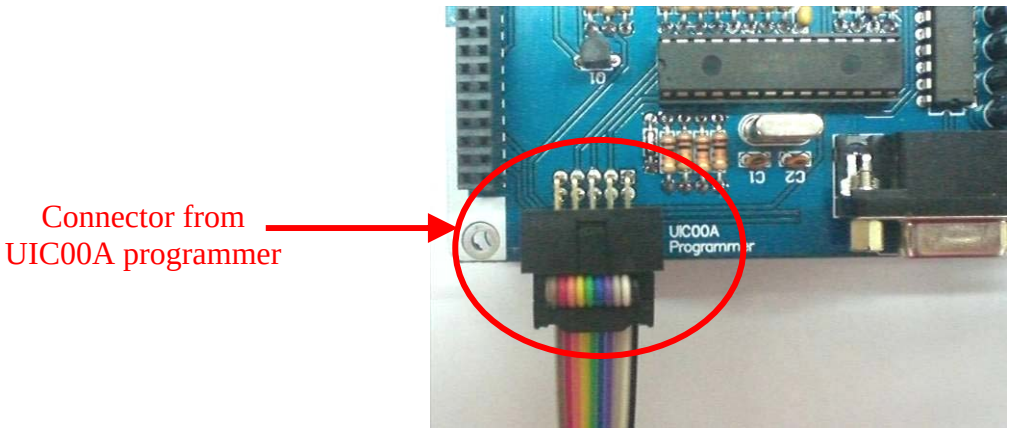


i. For those who want to understand the program, please refer to c file named "Sample1_AI.c" which is provided with this card.

j. Compile this project to generate hex file. Connect UIC00A IDC connector to IFC-MB00 as show. The hex file generated is named "IFC_AI08.hex".



k. Load the hex file generated to UIC00A using PICkit2 window (refer to UIC00A User's Manual for details). Power up IFC system if it is OFF.

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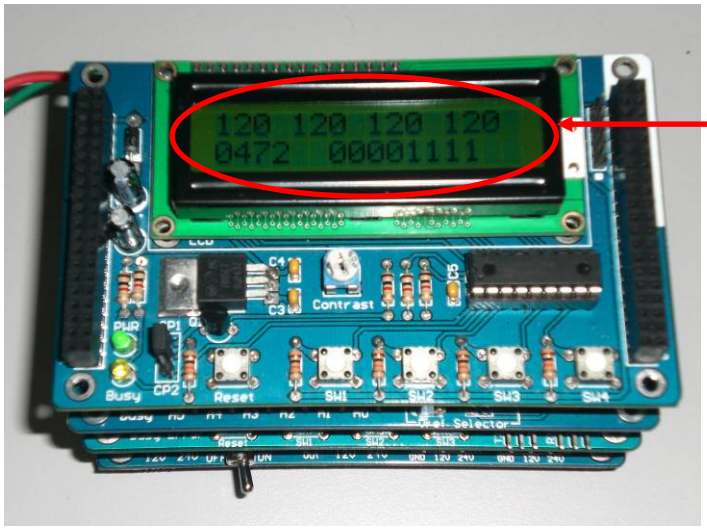
l. This sample project will display message at LCD on Control panel. When user power up IFC system, LCD will display random value if there is no device plug in the analog port. The figure show as below:



CP04 control panel display random value if no devices plug in the analog port.

m. There are 2 modes for user to select in program "Sample1_AI". These modes will display on CP04 control panel when IFC system is power up. User no needs to press any SW on CP04 to switch between modes. Mode 1 and mode 2 will function simultaneously. While analog port read the conversion stalling register, it also will compare the highest value from the port. The modes are:

Mode	Function
1	Read the value (conversion stalling register) from analog input port (port 1-5) and display the value at CP04 control panel. If there is no device plug in the analog port, the value returned are random (not zero).
2	Compare 4 analog port (port 1-4) and figure out the highest value. CP04 control panel will display the byte returned.

n. Please refer the comment in source code for the details of mode.

o. To remove a card from IFC system, the power should be switched OFF.

p. Please use proper tool to remove the card. User may refer last section in chapter 5.0 Installation (hardware) for the method to open card with provided IFC card opener.

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Note1: User may refer to IFC-AI08 Card Technical Info for the program function list. It will help user in writing program for IFC-AI08.

Note2: Each time open a new project for IFC, user need to add **ALL** header files and object files for all related IFC cards used. User also needs to include **ALL** cards' header file at the beginning of the program. Please refer sample source code for the example to include card h file.

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8. WARRANTY

- Product warranty is valid for 6 months.
- Warranty only applies to manufacturing defect.
- Damage caused by miss-use is not covered under warranty.
- Warranty does not cover freight cost for both ways.

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